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Working from Home – What is the Effect on Employees' Effort?

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Abstract

This paper investigates how working from home affects employees' work effort. Employees, who have the possibility to work from home, have a high autonomy in scheduling their work and therefore are assumed to have a higher intrinsic motivation. Thus, we expect working from home to positively influence work effort of employees. For the empirical analysis we use the German Socio-Economic Panel (SOEP). To account for self-selection into working locations we use an instrumental variable (IV) estimation strategy. Our empirical results show that working from home has a significantly positive influence on work effort. Moreover, we find that also the frequency of working from home is crucial. The more often employees work from home, the higher is the work effort they provide.

JEL Classification: J81; M50; M54

Keywords: working from home, job design, work effort, intrinsic motivation, reciprocity

1 Introduction

The prevalence of working from home arrangements in firms has increased over the past decades due to advancements in information and communication technologies (Shamir and Salomon 1985; Baruch 2000). In the year 2009, more than twenty percent of German firms provide their employees the possibility to work at least a couple of days per month from home (Flüter-Hoffmann 2012). [1] This possibility to work from home increases employees' autonomy in scheduling and organizing their work. Employees with higher autonomy have a stronger intrinsic motivation and are therefore willing to provide more work effort (Hackman and Oldham 1976; Bailey and Kurland 2002). Moreover, by offering agreeable working conditions, firms can attract and retain highly skilled and hard-working employees (DuBrin 1991).

However, empirical evidence on how working from home arrangements influence employees' work effort is scarce. Some studies analyze the relationship between working from home and employees' productivity using survey data (Bailyn 1988; Olson 1989; DuBrin 1991; Bélanger 1999). All four studies find a positive effect on employees' productivity. Yet, they use subjective indicators (Bailyn 1988; Olson 1989; Bélanger 1999), which measure the employees' perceived productivity change, or they use small data sets, which include only one firm in a specific industry (DuBrin 1991). Other studies investigate the influence of working from home on employees' productivity with data from laboratory or field experiments in order to estimate causal effects (Dutcher 2012; Bloom, Liang, Roberts and Ying 2015). Both studies find a significant positive effect of working from home on employees' productivity. Though, experimental results apply to a small subgroup of individuals and are not fully transferable to the whole population of employees.

Our contribution to the literature is twofold. First, we investigate the effect of working from home on employees' work effort with a large, individual-level dataset from Germany, the German Socio-Economic Panel (SOEP). By providing an empirical investigation across all industries and occupations, we obtain a comprehensive analysis of working from home arrangements with high external validity. Second, we account for the working from home frequency. Some studies mention that it is important to consider how often employees work from home (e.g. Oettinger 2011; Bailey and Kurland 2002), but do not include this measure in their empirical analysis. An exception is the study by Gariety and Shaffer (2007), who analyze the impact of working from

[1] For an overview of the working from home development in Germany for the years 1997 to 2009 see figure 1.

home on wages, and also include frequency measures into their empirical analysis. Therefore, we investigate the influence of working from home on work effort and also analyze the working from home frequency.

From a theoretical point of view, the impact of working from home on employees' work effort is ambiguous. As firms have fewer possibilities to monitor their employees, working from home might induces shirking and hence results in lower individual work effort (Gariety and Shaffer 2007). However, the possibility to work from home increases employees' autonomy and thus their intrinsic motivation (Hackman and Oldham 1976; Bailey and Kurland 2002). Therefore, employees, who work from home, might have a higher commitment and thus respond with "extra" work effort. Consequently, the degree of autonomy is also important. The more frequent employees stay at home, the larger has to be the effect of working from home on work effort.

For the empirical analysis we use the SOEP, which covers more than 22.000 individuals living in 12.000 households. To measure work effort, we calculate the difference between average actual working time and contractual working time following Beckmann, Cornelissen and Kräkel (2015). Our main explanatory variable indicates if an employee works from home or not. Moreover, we consider the degree of employees' autonomy by distinguishing four categories of the working from home frequency (i.e. "daily", "often", "sometimes" and "rarely").

Empirical studies, which analyze the characteristics of employees, who work from home, find that employees, who work from home, and those, who always stay in the office, systematically differentiate (e.g. Noonan and Glass 2012). The SOEP provides the possibility to control for observable individual, job and firm specific heterogeneity, for instance socio-economic background or working conditions. Though, unobserved characteristics can also cause self-selection into the working location. In order to reduce endogeneity biases, we additionally use a two-stage least squares estimation approach.

Our empirical results show that working from home increases employees' work effort. Using instrumental variable (IV) estimation strategy we get similar results. Working from home has a significant positive impact on work effort of employees. Additionally, we find evidence that also the frequency of working from home matters. Employees, who stay at home more often, provide a

higher work effort than those employees, who stay at home very rarely or work in the office. Thus, employees can benefit from a higher degree of autonomy, if they work from home more often.

The paper is organized as follows. In section 2, we present the related literature on working from home. Theoretical arguments, how working from home influences work effort, are discussed in section 3. In section 4, we give an overview of the used dataset and describe our first descriptive results. In section 5 follows an explanation of the estimation strategy. We discuss our empirical results in section 6. In this section we also present two robustness checks to give evidence that the higher work effort of employees is driven by intrinsic motivation. The paper concludes with a discussion in section 7.

2 Related Literature

Over the last three decades, researchers analyze working from home and its consequences in various disciplines like business and economics, environmental sciences or psychology (e.g. Bailyn 1988; Henderson, Koenig and Mokhtarian 1996; Gajendran and Harrison 2007). According to the literature, working from home is characterized by two main aspects. First, employees work outside the common workplace. Second, a connection between home and office exists. Information exchange and communication with colleagues is possible through the use of information and communication technologies (Bélanger 1999; Bailey and Kurland 2002). Moreover, the literature states that employees need to have a suitable job design for working from home. Working from home is most suitable for employees, who mainly have knowledge-based tasks, few face-to-face contacts and a high degree of autonomy (Bailey and Kurland 2002).

A majority of the studies focus on analyzing benefits and drawbacks of working from home (e.g. Baruch 2000; Gajendran and Harrison 2007) or analyze the influence of working from home on work-family balance (e.g. Sullivan and Lewis 2001; Hill, Ferris and Märtinson 2003; Golden, Veiga and Simsek 2006). In contrast, performance effects of working from home receive little attention in the literature.

Older studies, which investigate the relationship of working from home and employees' performance, primarily use case studies and survey data from specific industries (Bailyn 1988;

Olson 1989; DuBrin 1991; Bélanger 1999). Bailyn (1988) gives first insights into working from home and influences on employees using data from three case studies. All interviewed employees indicate that their perceived productivity increases while working from home. This positive impact on productivity is mainly attributed to a higher degree of autonomy and thus increased motivation. A quite similar study to Bailyn (1988) is the study by Olson (1989), who analyzes the consequences of working from home for employees and their employers, with data from three case studies. She finds that employees report a slight increase in perceived productivity. Though, employers state that they do not realize any productivity gains. Olson (1989) explains the merely moderate productivity increase at home in the three considered cases by bad technological equipment, which employees face at home. Another study that analyzes the impact of working from home on productivity is the study by DuBrin (1991). He uses data on clerical employees working in a large US market research firm, who can either work from home or stay in the office. Productivity is measured as data entries per hour for a project group. DuBrin (1991) shows in his empirical analysis that working from home increases group productivity. However, he compares changes in group productivity when projects are moved from office to working from home. Though, there is no comparison of productivity changes for the same employees. Bélanger (1999) investigates how working from home affects the perceived productivity of employees in the high technology sector. She finds that working from home is associated with higher perceived productivity. However, results need to be interpreted with caution as Bélanger (1999) also finds that employees self-select into working from home and therefore differentiate in their characteristics.

To address the self-selection problem of working from home and estimate causal effects, newer studies use experimental data (Dutcher 2012; Bloom et al. 2015). Dutcher (2012) investigates how working from home influences individual productivity by conducting a real-task laboratory experiment at a US university. He also considers the nature of the job task by distinguishing between creative and boring tasks. Dutcher (2012) finds that working from home increases productivity of individuals when doing creative tasks. Though, he finds that working from home has a negative influence on productivity if the task is too boring. Bloom et al. (2015) conduct a field experiment in a large Chinese travel agency to analyze the effect of working from home on employees' performance. Call center agents are randomly assigned to the two working locations; home and office. They measure overall performance as number of phone calls and length of phone

calls. Bloom et al. (2015) find that working from home increases overall performance of employees. They explain their finding by higher productivity associated with a quieter working atmosphere and also by higher work effort as employees tend to have fewer breaks. However, the results of both experimental studies apply to subgroups. Thus, a transfer to the whole working population is difficult.

We contribute to the literature by providing a more detailed analysis of working from home considering a huge number of different occupations and all industries and therefore conduct an empirical analysis with high external validity. Moreover, we use an indicator for work effort, which is still self-reported, but more objective than measures that rely on self-reported, perceived changes in individual productivity. To address endogeneity of the decision to work from home, we additionally provide an IV estimation.

3 Theoretical Background

Working from home has a twofold influence on employees. First, working from home offers employees a higher degree of autonomy than working in the office (Shamir and Salomon 1985). Referring to the job characteristics model by Hackman and Oldham (1976), job design especially the enrichment of jobs influences employees' motivation and working behavior. Hackman and Oldham (1976) argue that specific job characteristics including a high degree of autonomy have a positive impact on employees' motivation and performance. Hence, working from home should positively affect intrinsic motivation. As employers have fewer possibilities to monitor their employees at home, the offer of working from home is in addition an expression of appreciation and trust. According to Fehr and Gächter (2000), employees respond to benefits like the supply of working from home with reciprocal behavior in terms of "extra" work effort.

Second, working from home affects employees' working conditions. Working from home provides a more flexible scheduling of working time than working in the office. Employees can work at their most productive working hours, even at the night. In contrast, when staying in the office employees need to conform to general office hours and common breaks even though it is not their preferred scheduling of working time (Bailyn 1988). Moreover, at home employees are less often

distracted by colleagues and work in a quieter general working atmosphere, leading to reduced work-related stress (Bélanger 1999; Bloom et al. 2015).

Therefore, we assume that highly intrinsically motivated and more relaxed employees provide more work effort than their counterparts, who always stay in the office. Thus, we formulate our first hypothesis:

Hypothesis 1: Working from home increases employees' work effort.

The second purpose of our study is to analyze how the working from home frequency, i.e. how many days per month employees stay at home, influences work effort. Bailey and Kurland (2002) argue that advantages of working from home, in particular the increased autonomy are more pronounced the more frequent employees stay at home. Thus, we expect employees, who work from home very often, to provide higher work effort than employees, who only stay infrequent at home or always stay in the office. Hence, our second hypothesis is:

Hypothesis 2: The more frequent employees work from home, the higher is their work effort.

4 Data, Variables and Descriptive Statistics

In this section, we present the used dataset and give some descriptive statistics. Section 4.1 introduces the German Socio-Economic Panel and in section 4.2 we describe all included variables. In section 4.3, we analyze the characteristics of employees, who work from home, and compare them with characteristics of employees, who always stay in the office.

4.1 German Socio-Economic Panel

For our empirical analysis we draw on the SOEP, which is conducted yearly since 1984 by the German Institute for Economic Research (DIW). The SOEP is an internationally well-known individual-level dataset that covers more than 22.000 individuals, who live in more than 12.000 households (Wagner, Frick and Schupp 2007). As the SOEP is a large, representative dataset,

which includes individuals having different jobs and work in all German industries, we can provide a detailed analysis of working from home in Germany.[2]

This dataset perfectly fits our research question as it provides information on working locations and includes variables that indicate employees' work effort. Moreover, the SOEP contains information on individuals' socio-economic background and job characteristics. For our analysis we use data from the year 2009 and add information from the years 2002 and 2006. We include all employees working in the private and public sector aged between 17 and 65 years. Though, we exclude self-employed from our analysis as these persons have very irregular working hours, conditional on demand. Moreover, we exclude civil servants and apprentices, because their working hours are often regulated by law and they cannot freely decide how long they want to work in a week. To be included in the analysis, employees need to have a minimum wage of 400 euros. Our final sample contains 5311 observations.

4.2 Included Variables

We introduce two measures for working from home as explanatory variables. First, we include a binary variable, which takes the value 1 if an employee works from home and 0 otherwise. Second, we distinguish between four different forms of working from home to analyze the influence of the working from home frequency. The first category is "daily" working from home. Individuals in this category always work from home. The whole communication with colleagues and clients is through information and communication technologies (Bailey and Kurland 2002). Employees, who work a couple of days per week from home, but stay at least one day per week in the office, are categorized as "often" working from home. To work from home "sometimes" is defined as working from home one to two times in a month. The fourth category includes employees, who work very infrequently from home. This category is called "rarely" working from home. Our reference category denotes employees, who "never" work from home.

As dependent variable we use employees' work effort. Employees, who experience generous working conditions, for instance a high degree of autonomy when having the possibility to work from home, tend to reciprocal respond to these generous working conditions by providing "extra"

[2] For further information on the SOEP see Wagner et al. (2007).

work effort (Fehr and Gächter 2000). Therefore, we measure work effort as average actual working hours minus contractual working hours per week following Beckmann et al. (2015). A positive difference implies an intrinsic motivated "extra" work effort employees provide for their employer as the additional working time is not part of the work contract (Beckmann et al. 2015).

The SOEP provides a lot of information on the socio-economic background of individuals. We control for gender, age and nationality. As preferences for the working location depend on the family situation and induced responsibilities (Bélanger 1999), we include variables, which display individuals' housing situation. We account for living together with a partner and whether an employee has young children under the age of sixteen in his household. Additionally, we consider caring responsibilities for older or diseased family members. To capture personality traits we include a variable that measures the self-reported risk tolerance of employees. The financial situation is considered by employees' years of schooling that are interrelated to job position. Moreover, we control for the region in which individuals live.[3]

We also account for various job characteristics in our empirical analysis like individual experience or tenure and include whether an employee works part-time or under a fixed-term work contract. In addition, we have detailed information on specific job positions. We include nine dummy variables for occupation, which display different educational levels and task competencies. Moreover, we consider if someone has a leadership position. As employees' work effort depends on working conditions, we take job satisfaction and payment structure into consideration. The self-reported value for job satisfaction ranges from 0 to 10. To account for the payment structure, we insert two variables. First, we include monthly gross wage. Second, we include a binary variable that takes the value 1 if someone receives a performance-based pay as in the literature there is large empirical evidence that performance pay induces higher performance (e.g. Lazear 2000b; Cadsby, Song and Tapon 2007). To compute the performance-based pay dummy variable, we use information whether performance evaluations influence wages or bonuses. An important reason for the decision to work from home, which is often discussed in the working from home literature, is commuting distance (e.g. Baruch 2000). Therefore, we also account for the distance between firm and employees' home. Moreover, the SOEP even provides information on some firm

[3] We distinguish between the sixteen German federal states.

characteristics. We include four categories to capture firm size and insert ten dummy variables for industry.

Table 1 shows the descriptive statistics for all included variables.

[Insert Table 1 about here]

4.3 Characteristics of Employees, who Work from Home

In the literature there is no common view how typical employees, who work from home, are characterized. In empirical studies, findings on characteristics of employees, who work from home, depend on the definition of working from home and on the used data base (Bailey and Kurland 2002). However, all empirical studies find that employees who, work from home, and those employees, who stay in the office, systematically differentiate (e.g. DuBrin 1991; Bélanger 1999; Noonan and Glass 2012). We also get this impression if we compare the average employee, who works from home (WFH), with the average employee, who works in the office (WIO), in our sample of German employees.

Table 2 shows the descriptive results for the comparison of working from home with working in the office. We perform paired t-tests and report means and the corresponding p-values. We include employee characteristics that are often analyzed in empirical studies, like gender or family situation (e.g. Noonan and Glass 2012), and also include characteristics that theoretically influence the decision for the working location, like the commuting distance (Baruch 2000).

[Insert Table 2 about here]

Our descriptive results show that fewer women work from home than men. Forty-one percent of the employees, who decide to work from home, are women, whereas fifty-nine percent are men. For the employees, who work in the office, we find an equal gender distribution. This result is in contradiction to most of the empirical findings in the literature (e.g. DuBrin 1991; Bélanger 1999). Bélanger (1999) argues that working from home is mainly a preference for women. She explains her finding by the advantage of working from home to give women the chance to compare working and family lives. An explanation for our finding could be that in Germany employees

with different jobs work from home than for instance in the US. In comparison to Bélanger (1999), we find that a lot of employees with a leadership position decide to work from home. More than sixty percent of the employees, which work at least some days per month from home, have a leadership position. In contrast, only fifteen percent of the employees, who always stay in the office, have leading competencies. Thus, our descriptive results show that also highly productive employees with leadership positions work from home. Most of the employees, who fill in a leadership position, are men. Moreover, we find differences in the average years of schooling between employees, who decide to work from home, and those, who decide to stay in the office. Working from home goes together with longer education. This is in line with the argumentation that in Germany mainly well-educated employees with leadership positions use the possibility to work from home.

Working from home is not as prevalent for part-time employees as for full-time employees. Only seventeen percent of the employees, who work from home, have a part-time work contract, whereas twenty-four percent of the employees, who work in the office, also work part-time. This distinction is highly statistically significant. Hence, that there are differences between working from home and working in the office in terms of part-time experience is not astonishing. Employees, who stay in the office, have on average longer experience in part-time work.

As expected the family situation is crucial for the decision to work from home. Noonan and Glass (2012) argue that employees decide to work from home to take caring responsibilities. We find that employees, who decide to work from home, have more often a partner and also have more often young children under the age of sixteen in their households. Employees with caring responsibilities benefit most from the flexible scheduling of working time, which improves the work-family balance (Bailey and Kurland 2002).

We only find slightly differences in the age of employees, who work from home, and those, who work in the office. Both groups are between forty-three and forty-four years old on average. Interestingly, we do not find differences of employees, who work from home, and those, who work in the office, in terms of experience in full-time work and tenure. One would expect that only employees with long tenure and experience get the permission to work from home. But our descriptive results show that this is not the case. Our results for age and tenure go in line with those what is mostly found in the literature (Bélanger 1999; Noonan and Glass 2012).

The most interesting results are for commuting distance and monthly gross wage. Our descriptive results show that employees, who work from home, live on average thirty-three kilometers away from their firms' facilities. Employees, who stay the whole week in the office, have in comparison an average commuting distance of twenty kilometers. Thus, there is a selection of employees, who have a very long commuting way, into working from home to save time for productive tasks at home. This finding is also in line with the literature, as the saving of commuting time is an often mentioned advantage for working from home (Baruch 2000). The second interesting finding is that employees, who work from home, earn on average much more than employees, who stay in the office. This result is in line with the argumentation that employees with leading positions can decide to work a couple of days per month from home due to their higher bargaining power. Employees in top positions have high bargaining power and can better negotiate about preferable working conditions like the right to work from home (Bélanger 1999). Another explanation is that well-paid positions are often positions that have a lot of creative tasks. These employees can benefit more from a quieter working atmosphere at home than those employees with rather more simple tasks (Bailyn 1988).

5 Estimation Strategy

To analyze the impact of working from home on employees' work effort, we estimate the following equation using ordinary least squares (OLS):

$$work\ effort_i = \alpha + \beta\ WFH_i + X_i\gamma + u_{1_i} \quad (1)$$

Our dependent variable is work effort, which is measured as the difference between average actual working hours and contractual working hours for employee i. WFH_i captures the working location of an employee. WFH_i is a binary variable that takes the value 1 if someone works from home and 0 otherwise. X_i indicates all considered control variables. We introduce control variables for the socio-economic background and controls for job characteristics of individuals. Thereby, β and γ are the corresponding coefficients and u_{1_i} denotes the error term.

The impact of working from home on employees' work effort depends on frequency, as benefits of working from home, in particular individual's autonomy, are more pronounced the more often an

employee stays at home (Bailey and Kurland 2002). Therefore, we also analyze the influence of the working from home frequency on work effort with our second estimation equation:

$$work\ effort_i = \delta + \zeta\ WFH_{daily_i} + \eta\ WFH_{often_i} + \theta\ WFH_{sometimes_i} + \kappa\ WFH_{rarely_i} + X_i\lambda + u_{2_i} \qquad (2)$$

Here, we distinguish between four frequency levels, namely daily (WFH_{daily_i}), often (WFH_{often_i}), sometimes ($WFH_{sometimes_i}$) and rarely (WFH_{rarely_i}) as defined in section 4. The reference category is that an employee never works from home. ζ, η, θ and κ denote the corresponding coefficients and u_{2_i} is the error term.

In section 4, we show that the group of employees, who work from home, and those, who always stay in the office, systematically differentiate. We find for instance that employees, who have better education and higher earnings, more often decide to work from home. Employees' with family responsibilities and a longer commuting distance also more often opt for working from home. A self-selection into the working location can also be caused by unobserved characteristics and thus lead to biased and inconsistent OLS estimation results. In order to get meaningful results that can be interpreted in a causal manner, we perform an IV estimation approach. The following equation is our first stage estimation equation:

$$WFH_{i_{2009}} = \mu + \nu\ WFH_{i_{2002}} + \xi\ computer_{i_{2006}} + X_i\pi + \varepsilon_i \qquad (3)$$

We include two instruments for the working from home decision. First, we use the working location in the year 2002 ($WFH_{i_{2002}}$), as we expect a high correlation with the actual decision for the workplace, but no direct effect on work effort seven years later.[4] Second, we use employer-provided computer or laptop, which employees can use for job-related or personal purpose at home ($computer_{i_{2006}}$). We also expect a high correlation with the decision to work from home. A computer is a fringe benefit and therefore part of the firms' payment structure. As fringe benefits have a strong impact on employees' morale and intrinsic motivation and thus on employees' work effort (Kube, Maréchal and Puppe 2012), we use lagged information on employer-provided computer from the year 2006. Fringe benefits influence employees' work effort in the same year,

[4] The dataset provides information on employees' working location in the waves 1997, 1999, 2002 and 2009. We decide to use the working location in the year 2002 as this information is closest to the year 2009.

but should not have a long lasting effect on motivation.[5] Hence, $WFH_{i_{2002}}$ and $computer_{i_{2006}}$ are valid instruments for the decision to work from home. The corresponding coefficients are ν and ξ. We use the same set of control variables, denoted by X_i, and ε_i is the error term. For all equations we compute robust standard errors to deal with heteroskedasticity (White 1980). Subsequently, we insert the predicted value for working from home in equation (1).

6 Results

This section provides our empirical results. In section 6.1, we discuss the influence of working from home on employees' work effort. Section 6.2 addresses the question how the frequency of working from home affects employees' work effort. In section 6.3, we provide additional robustness checks to analyze if higher work effort is driven by intrinsic motivation or has other explanations.

6.1 Working from Home and Employees' Work Effort

We expect working from home to have a positive influence on work effort of employees as formulated in hypothesis 1. Table 3 shows the OLS estimation results.

[Insert Table 3 about here]

Specification (1) displays the estimation results without including any control variables. In specifications (2) and (3), we include either control variables for socio-economic background or job characteristics. In specification (4), the full set of control variables are included. The R-squared increases from 0.0723 to 0.2032, when we include all control variables indicating a better adjustment of the OLS estimation to the existing database. Thus, we refer to the estimation results in specification (4). Our empirical analysis shows that working from home is positively associated with employees' work effort. The corresponding coefficient is 2.4287 and statistically significant at the 1% level. Therefore, our first hypothesis is supported by the results. Considering the

[5] In the dataset, we only have information on employer-provided computer or laptop in the waves 2006 and 2008. As the motivational impact of received fringe benefits in the year 2008 might influences employees' work effort one year later, we use information on employer-provided computer from the year 2006.

estimation results in specifications (2) and (3), individuals' job characteristics explain the largest part of the working from home effect on work effort.

Our empirical analysis also indicates that women provide lower weekly work effort than men.[6] However, women have more often the responsibility to take care of children than men (Gajendran and Harrison 2007) and hence less time to provide "extra" work effort. This argumentation goes in line with the empirical result that having young children is also negatively associated with work effort. Tenure and age have a negative influence on work effort. An explanation can be that older employees, which are also those employees with the highest tenure, have a shorter remaining working time and hence lower career prospects (Davidson III, Xie, Xu and Ning 2007). Therefore, they do not need to show their ambition with "extra" work effort. Moreover, we find that having a leadership position is positively associated with work effort. Employees with leading competencies have more responsibility for tasks than the other employees. Though, they will work longer hours to finish time-critical tasks. A surprising result what we find is that job satisfaction influences work effort negatively. According to the job characteristics model (Hackman and Oldham 1976), one would expect that a higher job satisfaction leads to higher intrinsic motivation and therefore high job satisfaction should have a positive impact on work effort. However, the indicator for job satisfaction used here contains all aspects of the job, for instance wage or relationship to the boss or colleagues, and we do not know which aspect of the job drives the empirical result for job satisfaction.

In order to consider self-selection into the working location and hence to reach causal results, we perform an IV estimation. Table 4 presents the IV estimation results.[7]

[Insert Table 4 about here]

As instruments for working from home we use the working location seven years ago and whether an employee receives an employer-provided computer or laptop three years ago. Specification (1) displays the IV estimation results if we include WFH_2002 as instrument for working from home. In specification (2), we include both instruments (WFH_2002, Computer_2006). Our first stage estimation results show that both instruments have a positive and highly statistically significant influence on the decision to work from home in the year 2009, thus we refer to the IV estimation

[6] Empirical results for all control variables are displayed in table A1 in the appendix.
[7] For completeness, table A2 in the appendix notifies the IV estimation results for all control variables.

results in specification (2). The value of the Kleibergen-Paap F statistic is 93.4304. As this value exceeds the critical point of 10 considering the "rule of thumbs" established by Staiger and Stock (1997), we can conclude that both instruments are relevant. The second aspect for instruments to be valid is that they have to be exogenous. Thus, we test the overidentification restriction. The p-value of the Hansen J statistic is 0.2111 und hence substantial larger than the critical value of 0.1. The second stage estimation result indicates that the coefficient for working from home increases to 4.9400 compared to the OLS estimation result (2.4287) and is statistically significant at the 1% level. Therefore, our first hypothesis that working from home has a positive effect on employees' work effort is also supported by the IV estimation. Employees, who can work from home, provide nearly five hours more work effort per week than employees, who always stay in the office.

6.2 Working from Home Frequency and Employees' Work Effort

Table 5 displays the OLS estimation results for the empirical analysis how the working from home frequency affects work effort.[8] We expect that employees, who stay at home more often, to have a higher work effort than employees, who stay at home rarely or always stay in the office.

[Insert Table 5 about here]

Specification (1) reports the OLS estimation results without including any control variables. Control variables for socio-economic background or job characteristics are included in specification (2) and (3), respectively. In specification (4), we consider all control variables for socio-economic background and job characteristics, thus we refer to the estimation results in specification (4). All four coefficients have the expected signs. The four forms of working from home are positively associated with work effort of employees. However, we can identify striking differences between the distinct degrees of the working from home frequency. The corresponding coefficients for WFH_Daily, WFH_Often, WFH_Sometimes and WFH_Rarely are 5.6845, 3.1659, 2.1369 and 1.3584, respectively (statistically significant at the 1% level). As expected, the more often employees work from home the higher is the work effort they provide, supporting our second hypothesis.

[8] Table A3 in the Appendix displays the OLS estimation results for all control variables.

6.3 Robustness Checks

A possible risk of working from home, which is often proclaimed in the literature, is that it induces shirking (e.g. Gariety and Shaffer 2007; Noonan and Glass 2012). However, we argue that working from home increases autonomy and hence intrinsic motivation. Therefore, working from home incentivizes employees to provide "extra" work effort.

To provide evidence that employees provide intrinsic motivated higher work effort, we separate our sample in two subgroups. We distinguish between employees, who receive performance pay, and those employees, who receive a fixed wage. Employees, who receive performance pay, have a payment structure that is output-oriented. Thus, these employees have no incentive for shirking (Lazear 2000a). If working from home induces shirking, it should only influence work effort of employees, who get a fixed wage.

Table 6 shows the empirical results for the analysis how working from home influences work effort, separated for the two payment schemes.[9]

[Insert Table 6 about here]

Specification (1) displays the results for employees with performance pay and specification (2) displays the results for employees with a fixed wage. The corresponding coefficients for employees, who receive performance pay and work from home, and for employees, who receive a fixed wage and work from home, are 2.3907 and 2.5380, respectively (statistically significant at the 1% level). Both results show that working from home has a quite similar influence on employees with different payment schemes. Employees, who receive a fixed wage, even provide slightly more work effort. The empirical results support our theoretical explanation that employees perceive working from home as a fringe benefit, which offers more autonomy, and hence they respond with higher work effort.

Our empirical results in section 6.1 show that employees, who have the possibility to work from home, provide substantial higher work effort. However, using this indicator for work effort we cannot analyze the reasons why employees are willing to provide more working hours in a week. Is "extra" work effort really induced by higher intrinsic motivation as we expect in our theoretical

[9] Table A4 in the appendix notifies estimation results including regression coefficients for all control variables.

argumentation? Another explanation for longer working hours at home might be that employees have an extrinsic incentive, i.e. additional pay. Therefore, in a next step we analyze the impact of working from home on weekly overtime hours and distinguish between paid and unpaid overtime.

Table 7 displays the OLS estimation results for the influence of working from home on overtime hours.[10]

[Insert Table 7 about here]

Specification (1) displays the impact of working from home on weekly paid overtime hours and specification (2) on weekly unpaid overtime hours, respectively. Our empirical analysis indicates that working from home is compared to working in the office negatively associated with paid overtime hours. The size of the regression coefficient is -0.1959 (statistically significant at the 10% level). In contrast, working from home is positively associated with weekly unpaid overtime hours. The corresponding regression coefficient is 1.3185 (statistically significant at the 1% level).Thus, we can conclude that working from home indeed induces intrinsic motivation. Furthermore, our empirical findings show, if employees receive extrinsic motivation, i.e. additional payment, employees, who work from home, provide even less paid overtime hours per week than their counterparts, who always stay in the office.

7 Discussion

This study investigates how working from home influences employees' work effort. According to Gajendran and Harrison (2007) only a minority of employees always work from home, the majority spend just a few days per month at home. Therefore, it is also important for employers to know how employees' work effort is affected by frequency. Thus, we additionally consider the working from home frequency in our empirical analysis.

However, a lot of employers fear that employees exploit the freedom when working from home and lower their individual work effort (Gariety and Shaffer 2007). In contrast, considering theoretical models from behavioral economics, for instance the job characteristics model by

[10] For completeness, we report estimation results for all control variables in table A5.

Hackman and Oldham (1976), increased autonomy in organizing work boosts intrinsic motivation and hence induces higher work effort (Hackman and Oldham 1976).

Our empirical analysis shows that working from home has a statistically significant positive effect on work effort. As the decision to work from home is endogenous, we also conduct an IV estimation to account for a self-selection into the working location. Empirical results also hold in the IV estimation. Furthermore, we find that employees, who work from home more frequently, provide higher work effort than employees, who only stay very infrequently at home or always stay in the office.

Additional empirical analyses show that increased work effort is intrinsically motivated "extra" work effort as we find that working from home also has a positive impact on unpaid overtime hours and is even negatively associated with paid overtime. The last question that remains is if this "extra" work effort is productive. Bloom et al. (2015) indicate in their study with experimental data that employees, who can work from home, have an increased work effort. This result is in line with our empirical findings. Moreover, they find that employees, who work from home, are also more productive. Thus, implementing working from home seems to be a beneficial strategy for firms.

In addition to inducing higher work effort, employers can benefit from the implementation of working from home, as they can save operating costs due to reduced office space (Bloom et al. 2015). Though, they should be aware of challenges and potential problems. First, working from home should be an option. As employees have different preferences, mandatory working from home could induce dissatisfaction (Bélanger 1999). Additionally, working from home is experienced by employees as a benefit and a symbol of appreciation and trust if it is voluntary. Only under this condition, employees respond to working from home with "extra" work effort (Fehr and Gächter 2000). Second, a potential drawback of working from home is that it can cause personal and professional isolation, because employees have reduced social interaction (Hill et al. 2003). Therefore, firms need to adjust their organizational culture to working from home. Employees need to have regular face-to-face team meetings with supervisors and colleagues to share important information, to feel integrated in the team and to identify with the company (Bailyn 1988). Third, employees have the highest intrinsic motivation if they are not only

responsible for their work but also get regular feedback on their performance (Hackman and Oldham 1976). Thus, firms need to make sure that they provide appropriate feedback.

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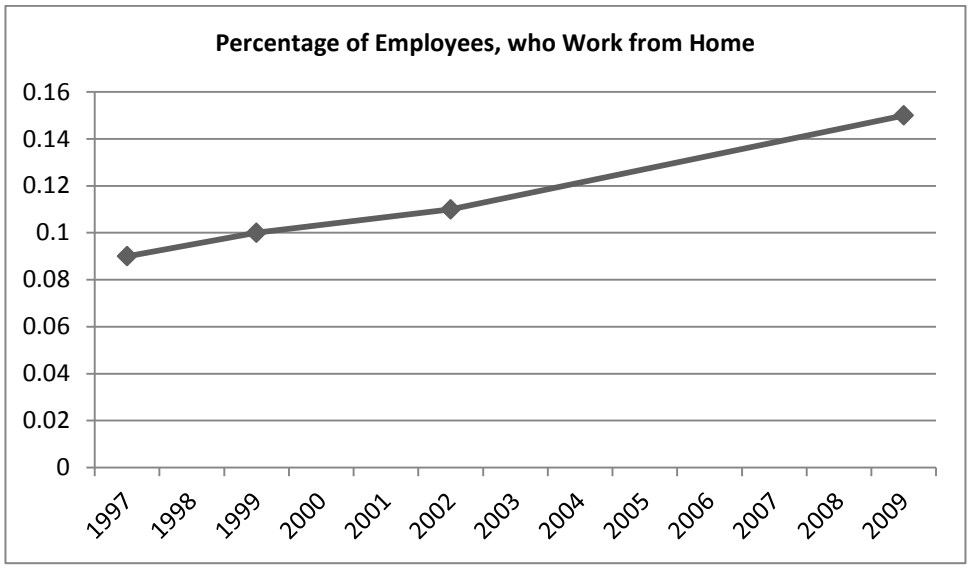
Figures

Figure 1. Development of Working from Home (WFH) in Germany (1997-2009)



Source: SOEP (waves 1997, 1999, 2002 and 2009), own calculations.

Note: Apprentices, civil servants and self-employed individuals are excluded.

Tables

Table 1. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Dependent Variable					
Work Effort	5311	3.851	5.534	-17.000	40.000
Explanatory Variables					
WFH	5311	0.148	0.355	0	1
WFH Frequency					
WFH_Daily	5311	0.018	0.131	0	1
WFH_Often	5311	0.031	0.172	0	1
WFH_Sometimes	5311	0.032	0.177	0	1
WFH_Rarely	5311	0.068	0.251	0	1
WFH_Never	5311	0.852	0.355	0	1
Socio-Economic Background					
Female	5311	0.489	0.500	0	1
Age	5311	43.831	10.112	19	65
Partner	5311	0.847	0.360	0	1
Foreign	5311	0.054	0.225	0	1
Years of Schooling	5311	12.581	2.554	7	18
Children under 16 Years	5311	0.329	0.470	0	1
Caring Responsibilities	5311	0.014	0.118	0	1
Risk Tolerance	5311	3.962	2.088	0	10
Region					
Baden-Württemberg	5311	0.128	0.334	0	1
Bavaria	5311	0.147	0.354	0	1
Berlin	5311	0.034	0.180	0	1
Brandenburg	5311	0.039	0.194	0	1
Bremen	5311	0.007	0.083	0	1
Hamburg	5311	0.013	0.112	0	1
Hesse	5311	0.071	0.256	0	1
Mecklenburg-Western Pomerania	5311	0.024	0.153	0	1
Lower Saxony	5311	0.089	0.284	0	1
North Rhine-Westphalia	5311	0.197	0.398	0	1
Rhineland-Palatinate	5311	0.044	0.206	0	1
Saarland	5311	0.012	0.108	0	1
Saxony	5311	0.081	0.272	0	1
Saxony-Anhalt	5311	0.044	0.205	0	1
Schleswig-Holstein	5311	0.026	0.158	0	1
Thuringia	5311	0.046	0.209	0	1

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Job Characteristics					
Part-time Work	5311	0.226	0.418	0	1
Fixed-term Work	5311	0.072	0.258	0	1
Occupational Position					
Untrained Worker	5311	0.024	0.152	0	1
Semi-trained Worker	5311	0.099	0.299	0	1
Trained Worker	5311	0.142	0.349	0	1
Foreman	5311	0.025	0.155	0	1
Master Craftsman	5311	0.010	0.100	0	1
Industry Foreman	5311	0.006	0.075	0	1
Employee, Without Training	5311	0.027	0.164	0	1
Employee, With Training	5311	0.106	0.308	0	1
Employee, Qualified Duties	5311	0.304	0.474	0	1
Leadership Position	5311	0.221	0.415	0	1
Experience					
Experience in Full-time Work	5311	17.174	11.083	0	47.400
Experience in Part-time Work	5311	3.225	5.742	0	38.000
Experience in Unemployment	5311	0.565	1.369	0	24.100
Tenure	5311	12.340	9.923	0	48.000
Job Satisfaction	5311	6.873	2.014	0	10
Monthly Gross Wage	5311	2690.630	1615.831	400.000	24315.000
Performance Pay	5311	0.191	0.393	0	1
Commuting Distance	5311	22.231	53.203	0	999
Firm Size					
Firm Size I (< 20 Employees)	5311	0.201	0.401	0	1
Firm Size II (20-200 Employees)	5311	0.304	0.460	0	1
Firm Size III (201-2000 Employees)	5311	0.249	0.432	0	1
Firm Size IV (> 2000 Employees)	5311	0.246	0.431	0	1
Industry					
Agriculture & Forestry	5311	0.008	0.092	0	1
Mining & Energy	5311	0.016	0.126	0	1
Manufacturing	5311	0.285	0.451	0	1
Construction	5311	0.043	0.203	0	1
Trade	5311	0.119	0.324	0	1
Transport & Communication	5311	0.055	0.228	0	1
Banking & Insurance	5311	0.051	0.220	0	1
Firm-Related Services	5311	0.082	0.275	0	1
Other Services	5311	0.258	0.438	0	1
Public Organizations	5311	0.083	0.275	0	1

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Instruments					
WFH_2002	3769	0.109	0.312	0	1
Computer_2006	3769	0.035	0.185	0	1
Robustness Check					
Paid Overtime Hours	3843	0.718	2.316	0	24.750
Unpaid Overtime Hours	3843	2.648	3.824	0	24.750

Source: SOEP (waves 2002, 2006 and 2009), own calculations.

Note: Work effort is defined as average actual working hours minus contractual working hours per week. 18 years of schooling correspond to a university degree. For the instruments we use information from the years 2002 and 2006, respectively. For all other variables we use information from the year 2009. The variables paid overtime hours and unpaid overtime hours have more missing values and thus fewer observations. We calculate average weekly overtime hours.

Table 2. Comparison of Working from Home (WFH) and Working in the Office (WIO)

	WFH	WIO		
	Mean	Mean	Diff.	P-Value
Female	0.4066	0.5038	-0.0972	0.0000
Age	44.4219	43.7277	0.6942	0.0637
Partner	0.8844	0.8400	0.0444	0.0005
Children under 16 Years	0.3787	0.3203	0.0584	0.0018
Years of Schooling	14.6506	12.2214	2.4292	0.0000
Part-time Work	0.1690	0.2361	-0.0671	0.0000
Experience in Full-time Work	17.2165	17.1670	0.0495	0.9048
Experience in Part-time Work	2.6982	3.3161	-0.6179	0.0015
Tenure	11.9502	12.4079	-0.4577	0.2245
Leadership Position	0.6366	0.1492	0.4874	0.0000
Monthly Gross Wage	3942.7010	2472.8190	1469.8820	0.0000
Commuting Distance	33.1741	20.3271	12.8470	0.0000

Source: SOEP (wave 2009), own calculations.

Note: In total we have 5311 observations, 787 for WFH and 4524 for WIO.

Table 3. Working from Home (WFH) and Work Effort (OLS Estimation)

	Work Effort			
	(1)	(2)	(3)	(4)
WFH	4.1870***	3.5044***	2.4086***	2.4287***
	(0.2657)	(0.2765)	(0.2842)	(0.2815)
Socio-Economic Background	no	yes	no	yes
Job Characteristics	no	no	yes	yes
Constant	3.2307***	1.9524***	1.8405***	4.4343***
	(0.0735)	(0.6199)	(0.5404)	(0.8399)
Observations	5311	5311	5311	5311
R-Squared	0.0723	0.1180	0.1866	0.2032

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. Specification (1) does not include any control variables. Specifications (2) and (3) only include control variables for socio-economic background and job characteristics, respectively. In specification (4), we include all control variables for socio-economic background and job characteristics as listed in table 1.

Table 4. Working from Home (WFH) and Work Effort (IV Estimation (2SLS))

	First Stage		Second Stage	
	WFH		Work Effort	
	(1)	(2)	(1)	(2)
WFH			4.3366***	4.9400***
			(1.1309)	(1.0581)
WFH_2002	0.3114***	0.2942***		
	(0.0259)	(0.0261)		
Computer_2006		0.2285***		
		(0.0429)		
Socio-Economic Background	yes	yes	yes	yes
Job Characteristics	yes	yes	yes	yes
Constant	-0.1457**	-0.1372**	4.8769***	5.0044***
	(0.0575)	(0.0571)	(1.0013)	(0.9953)
Observations	3769	3769	3769	3769
Kleibergen-Paap F Statistic	144.6965	93.4304		
Hansen J Statistic				
P-Value		0.2111		
Centered R-Squared	0.2992	0.3116	0.2073	0.1981

Source: SOEP (waves 2002, 2006 and 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. In the IV estimation are fewer observations than in the OLS estimation as we only include employees who can be observed in all three years (2002, 2006 and 2009). In specification (1), we include WFH_2002 as instrument for WFH. In specification (2), we include two instruments for WFH; WFH_2002 and computer_2006. Both specifications include all control variables for socio-economic background and job characteristics as listed in table 1.

Table 5. Working from Home **(**WFH) Frequency and Work Effort (OLS Estimation)

	Work Effort			
	(1)	(2)	(3)	(4)
WFH_Daily	7.1424***	6.8408***	5.6037***	5.6845***
	(0.9861)	(0.9599)	(0.9104)	(0.9059)
WFH_Often	4.7723***	4.2147***	3.0702***	3.1659***
	(0.6129)	(0.6086)	(0.5964)	(0.5894)
WFH_Sometimes	4.1745***	3.3193***	2.1187***	2.1369***
	(0.5317)	(0.5310)	(0.5192)	(0.5121)
WFH_Rarely	3.1617***	2.3970***	1.3873***	1.3584***
	(0.3229)	(0.3260)	(0.3333)	(0.3298)
Socio-Economic Background	no	yes	no	yes
Job Characteristics	no	no	yes	yes
Constant	3.2307***	2.0766***	1.9393***	4.5598***
	(0.0735)	(0.6196)	(0.5394)	(0.8356)
Observations	5311	5311	5311	5311
R-Squared	0.0799	0.1276	0.1951	0.2122

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. The reference category for the working from home frequency is WFH_Never. Specification (1) does not include any control variables. Specifications (2) and (3) only include control variables for socio-economic background and job characteristics, respectively. In specification (4), we include all control variables for socio-economic background and job characteristics as listed in table 1.

Table 6. Working from Home (WFH) and Work Effort (OLS Estimation)

	Work Effort	
	(1)	(2)
	Performance Pay	Fixed Wage
WFH	2.3907***	2.5380***
	(0.4823)	(0.3438)
Socio-Economic Background	yes	yes
Job Characteristics	yes	yes
Constant	5.1211**	4.2129***
	(2.0044)	(0.9239)
Observations	1014	4297
R-Squared	0.2539	0.1981

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. In specification (1), we only include employees, who receive a performance pay. Employees, who receive a fixed wage, are included in specification (2). Both specifications include all control variables for socio-economic background and job characteristics as listed in table 1.

Table 7. Working from Home (WFH) and Overtime Hours (OLS Estimation)

	Paid Overtime Hours	Unpaid Overtime Hours
	(1)	(2)
WFH	-0.1959*	1.3185***
	(0.1006)	(0.2168)
Socio-Economic Background	yes	yes
Job Characteristics	yes	yes
Constant	2.2901***	2.2865***
	(0.5449)	(0.7203)
Observations	3843	3843
R-Squared	0.0726	0.1314

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. The variables paid overtime hours and unpaid overtime hours have more missing values and thus fewer observations. We calculate average weekly overtime hours. Specification (1) and (2) include all control variables for socio-economic background and job characteristics as listed in table 1.

Appendix

Table A1. Working from Home (WFH) and Work Effort (OLS Estimation)

	Work Effort			
	(1)	(2)	(3)	(4)
WFH	4.1870***	3.5044***	2.4086***	2.4287***
	(0.2657)	(0.2765)	(0.2842)	(0.2815)
Socio-Economic Background				
Female		-1.6004***		-0.7130***
		(0.1442)		(0.1869)
Age		-0.0151**		-0.0374**
		(0.0076)		(0.0177)
Partner		-0.1873		-0.3486*
		(0.2083)		(0.2030)
Foreign		-0.7277***		-0.4567*
		(0.2785)		(0.2769)
Years of Schooling		0.2064***		-0.1050**
		(0.0351)		(0.0430)
Children under 16 Years		-0.5996***		-0.5458***
		(0.1587)		(0.1594)
Caring Responsibilities		0.5131		0.4430
		(0.8136)		(0.6932)
Risk Tolerance		0.1099***		0.0592*
		(0.0367)		(0.0351)
Job Characteristics				
Part-time Work			-0.5529***	-0.0482
			(0.2126)	(0.2269)
Fixed-term Work			0.5203*	0.4132
			(0.3002)	(0.2983)
Leadership Position			1.4069***	1.5800***
			(0.4762)	(0.5099)
Experience in Full-time Work			-0.0074	0.0108
			(0.0089)	(0.0180)
Experience in Part-time Work			0.0041	0.0446*
			(0.0154)	(0.0239)
Experience in Unemployment			0.0107	0.0143
			(0.0480)	(0.0498)
Tenure			-0.0404***	-0.0406***
			(0.0095)	(0.0095)

	Work Effort			
	(1)	(2)	(3)	(4)
Job Satisfaction			-0.2098***	-0.2032***
			(0.0375)	(0.0373)
Monthly Gross Wage			0.0009***	0.0010***
			(0.0001)	(0.0001)
Performance Pay			0.0649	0.0359
			(0.1982)	(0.2000)
Commuting Distance			0.0056***	0.0047**
			(0.0021)	(0.0021)
Constant	3.2307***	1.9524***	1.8405***	4.4343***
	(0.0735)	(0.6199)	(0.5404)	(0.8399)
Observations	5311	5311	5311	5311
R-Squared	0.0723	0.1180	0.1866	0.2032

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. Furthermore, we include 16 regional dummies in specifications (2) and (4) as well as 9 dummies for occupational position, 4 firm size dummies and 10 industry dummies in specifications (3) and (4) as listed in table 1.

Table A2. Working from Home (WFH) and Work Effort (IV Estimation (2SLS))

	First Stage		Second Stage	
	WFH		Work Effort	
	(1)	(2)	(1)	(2)
WFH			4.3366***	4.9400***
			(1.1309)	(1.0581)
WFH_2002	0.3114***	0.2942***		
	(0.0259)	(0.0261)		
Computer_2006		0.2285***		
		(0.0429)		
Socio-Economic Background				
Female	-0.0160	-0.0172	-0.6377***	-0.6272***
	(0.0145)	(0.0143)	(0.2227)	(0.2242)
Age	-0.0012	-0.0011	-0.0452**	-0.0450**
	(0.0014)	(0.0014)	(0.0215)	(0.0215)
Partner	0.0011	0.0011	-0.1898	-0.1891
	(0.0140)	(0.0139)	(0.2448)	(0.2455)
Foreign	0.0149	0.0128	-0.4199	-0.4281
	(0.0182)	(0.0186)	(0.3324)	(0.3337)
Years of Schooling	0.0103***	0.0107***	-0.1637***	-0.1725***
	(0.0035)	(0.0034)	(0.0539)	(0.0534)
Children under 16 Years	0.0107	0.0085	-0.7573***	-0.7694***
	(0.0124)	(0.0123)	(0.1915)	(0.1929)
Caring Responsibilities	-0.0186	-0.0100	0.1134	0.1197
	(0.0359)	(0.0360)	(0.7740)	(0.7780)
Risk Tolerance	0.0027	0.0021	0.0301	0.0284
	(0.0023)	(0.0023)	(0.0414)	(0.0415)
Job Characteristics				
Part-time Work	0.0165	0.0182	0.0032	-0.0068
	(0.0179)	(0.0179)	(0.2701)	(0.2705)
Fixed-term Work	-0.0100	-0.0080	0.7610*	0.7613*
	(0.0263)	(0.0256)	(0.4449)	(0.4483)
Leadership Position	0.2038***	0.1934***	1.2744**	1.1314*
	(0.0300)	(0.0295)	(0.6500)	(0.6432)
Experience in Full-time Work	0.0013	0.0010	0.0150	0.0141
	(0.0014)	(0.0014)	(0.0214)	(0.0215)
Experience in Part-time Work	0.0021	0.0017	0.0499*	0.0482*
	(0.0018)	(0.0018)	(0.0282)	(0.0282)

	First Stage		Second Stage	
	WFH		Work Effort	
	(1)	(2)	(1)	(2)
Experience in Unemployment	-0.0054*	-0.0050*	0.0734	0.0780
	(0.0029)	(0.0029)	(0.0697)	(0.0699)
Tenure	-0.0008	-0.0007	-0.0384***	-0.0377***
	(0.0006)	(0.0006)	(0.0109)	(0.0109)
Job Satisfaction	0.003	0.0025	-0.1994***	-0.2015***
	(0.0023)	(0.0022)	(0.0436)	(0.0437)
Monthly Gross Wage	0.0000***	0.0000***	0.0010***	0.0010***
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Performance Pay	0.0512***	0.0431***	-0.0030	-0.0370
	(0.0150)	(0.0148)	(0.2415)	(0.2428)
Commuting Distance	0.0002	0.0001	0.0061**	0.0059**
	(0.0001)	(0.0001)	(0.0024)	(0.0025)
Constant	-0.1457**	-0.1372**	4.8769***	5.0044***
	(0.0575)	(0.0571)	(1.0013)	(0.9953)
Observations	3769	3769	3769	3769
Kleibergen-Paap F Statistic	144.6965	93.4304		
Hansen J Statistic				
P-Value		0.2111		
Centered R-Squared	0.2992	0.3116	0.2073	0.1981

Source: SOEP (waves 2002, 2006 and 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. In the IV estimation are fewer observations than in the OLS estimation as we only include employees who can be observed in all three years (2002, 2006 and 2009). In specification (1), we include WFH_2002 as instrument for WFH. In specification (2), we include two instruments for WFH; WFH_2002 and computer_2006. Furthermore, we include 16 regional dummies, 9 dummies for occupational position, 4 firm size dummies and 10 industry dummies in both specifications as listed in table 1.

Table A3. Working from Home (WFH) Frequency and Work Effort (OLS Estimation)

	Work Effort			
	(1)	(2)	(3)	(4)
WFH_Daily	7.1424***	6.8408***	5.6037***	5.6845***
	(0.9861)	(0.9599)	(0.9104)	(0.9059)
WFH_Often	4.7723***	4.2147***	3.0702***	3.1659***
	(0.6129)	(0.6086)	(0.5964)	(0.5894)
WFH_Sometimes	4.1745***	3.3193***	2.1187***	2.1369***
	(0.5317)	(0.5310)	(0.5192)	(0.5121)
WFH_Rarely	3.1617***	2.3970***	1.3873***	1.3584***
	(0.3229)	(0.3260)	(0.3333)	(0.3298)
Socio-Economic Background				
Female		-1.6604***		-0.7422***
		(0.1432)		(0.1852)
Age		-0.0171**		-0.0353**
		(0.0076)		(0.0175)
Partner		-0.1829		-0.3451*
		(0.2068)		(0.2016)
Foreign		-0.7182***		-0.4483
		(0.2776)		(0.2746)
Years of Schooling		0.2040***		-0.1129***
		(0.0349)		(0.0424)
Children under 16 Years		-0.6053***		-0.5485***
		(0.1579)		(0.1582)
Caring Responsibilities		0.3826		0.3164
		(0.7952)		(0.6904)
Risk Tolerance		0.1165***		0.0641*
		(0.0366)		(0.0350)
Job Characteristics				
Part-time Work			-0.5958***	-0.0875
			(0.2105)	(0.2247)
Fixed-term Work			0.5120*	0.4001
			(0.2990)	(0.2971)
Leadership Position			1.3867***	1.5941***
			(0.4748)	(0.5075)
Experience in Full-time Work			-0.0089	0.0072
			(0.0089)	(0.0178)

	Work Effort			
	(1)	(2)	(3)	(4)
Experience in Part-time Work			0.0014	0.0401*
			(0.0152)	(0.0235)
Experience in Unemployment			0.0130	0.0156
			(0.0483)	(0.05)
Tenure			-0.0414***	-0.0417***
			(0.0094)	(0.0094)
Job Satisfaction			-0.2161***	-0.2101***
			(0.0374)	(0.0372)
Monthly Gross Wage			0.0009***	0.0010***
			(0.0001)	(0.0001)
Performance Pay			0.1048	0.0760
			(0.1977)	(0.1995)
Commuting Distance			0.0054***	0.0045**
			(0.0021)	(0.0021)
Constant	3.2307***	2.0766***	1.9393***	4.5598***
	(0.0735)	(0.6196)	(0.5394)	(0.8356)
Observations	5311	5311	5311	5311
R-Squared	0.0799	0.1276	0.1951	0.2122

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. The reference category for the working from home frequency is WFH_Never. Furthermore, we include 16 regional dummies in specifications (2) and (4) as well as 9 dummies for occupational position, 4 firm size dummies and 10 industry dummies in specifications (3) and (4) as listed in table 1.

Table A4. Working from Home (WFH) and Work Effort (OLS Estimation)

	Work Effort	
	(1)	(2)
	Performance Pay	Fixed Wage
WFH	2.3907***	2.5380***
	(0.4823)	(0.3438)
Socio-Economic Background		
Female	-0.1834	-0.8367***
	(0.4283)	(0.2113)
Age	-0.1880***	-0.0135
	(0.0506)	(0.0189)
Partner	-1.0089*	-0.2069
	(0.5799)	(0.2131)
Foreign	-0.9704*	-0.3547
	(0.5472)	(0.3164)
Years of Schooling	-0.0146	-0.1224**
	(0.0984)	(0.0478)
Children under 16 Years	-0.6572*	-0.5217***
	(0.3861)	(0.1752)
Caring Responsibilities	-2.0918**	0.9082
	(0.9219)	(0.7803)
Risk Tolerance	0.2194**	0.0286
	(0.0918)	(0.0384)
Job Characteristics		
Part-time Work	-0.8696	0.1350
	(0.6163)	(0.2505)
Fixed-term Work	-0.3883	0.5238*
	(0.7022)	(0.3177)
Leadership Position	2.7654**	1.5581***
	(1.1783)	(0.5607)
Experience in Full-time Work	0.1329***	-0.0071
	(0.0514)	(0.0191)
Experience in Part-time Work	0.2129***	0.0218
	(0.0727)	(0.0254)
Experience in Unemployment	0.3277	-0.0130
	(0.2802)	(0.0507)
Tenure	-0.0415*	-0.0418***
	(0.0228)	(0.0105)

	Work Effort	
	(1)	(2)
	Performance Pay	Fixed Wage
Job Satisfaction	-0.0470	-0.2368***
	(0.0928)	(0.0404)
Monthly Gross Wage	0.0009***	0.0010***
	(0.0002)	(0.0002)
Commuting Distance	-0.0017	0.0066***
	(0.0043)	(0.0023)
Constant	5.1211**	4.2129***
	(2.0044)	(0.9239)
Observations	1014	4297
R-Squared	0.2539	0.1981

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. Work effort is defined as average actual working hours minus contractual working hours per week. In specification (1), we only include employees, who receive a performance pay. Employees, who receive a fixed wage, are included in specification (2). Furthermore, we include 16 regional dummies in specifications (2) and (4) as well as 9 dummies for occupational position, 4 firm size dummies and 10 industry dummies in specifications (3) and (4) as listed in table 1.

Table A5. Working from Home (WFH) and Overtime Hours (OLS Estimation)

	Paid Overtime Hours	Unpaid Overtime Hours
	(1)	(2)
WFH	-0.1959*	1.3185***
	(0.1006)	(0.2168)
Socio-Economic Background		
Female	-0.2137***	-0.0604
	(0.0805)	(0.1627)
Age	-0.0031	-0.0276*
	(0.0107)	(0.0155)
Partner	-0.0658	-0.0016
	(0.1049)	(0.1597)
Foreign	0.0411	-0.2081
	(0.2041)	(0.2699)
Years of Schooling	-0.0652***	-0.0204
	(0.0236)	(0.0367)
Children under 16 Years	-0.0781	0.0468
	(0.0897)	(0.1370)
Caring Responsibilities	0.8056	-0.6622
	(0.5434)	(0.4251)
Risk Tolerance	-0.0328*	0.0205
	(0.0190)	(0.0310)
Job Characteristics		
Part-time Work	0.3464**	-0.4311**
	(0.1372)	(0.1956)
Fixed-term Work	-0.1276	0.3710
	(0.1492)	(0.2486)
Leadership Position	-0.9259**	1.5559***
	(0.3969)	(0.4434)
Experience in Full-time Work	-0.0104	0.0313**
	(0.0103)	(0.0160)
Experience in Part-time Work	0.0027	0.0421*
	(0.0120)	(0.0223)
Experience in Unemployment	0.0210	0.0320
	(0.0335)	(0.0383)
Tenure	-0.0150***	-0.0217***
	(0.0053)	(0.0082)

	Paid Overtime Hours	Unpaid Overtime Hours
	(1)	(2)
Job Satisfaction	-0.0092	-0.0869***
	(0.0191)	(0.0314)
Monthly Gross Wage	0.0003***	0.0003***
	(0.0001)	(0.0001)
Performance Pay	-0.2679***	0.0169
	(0.0934)	(0.1653)
Commuting Distance	0.0005	0.0011
	(0.0008)	(0.0013)
Constant	2.2901***	2.2865***
	(0.5449)	(0.7203)
Observations	3843	3843
R-Squared	0.0726	0.1314

Source: SOEP (wave 2009), own calculations.

Note: Robust standard errors in parentheses. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level. The variables paid overtime hours and unpaid overtime hours have more missing values and thus fewer observations. We calculate average weekly overtime hours. Furthermore, we include 16 regional dummies in specifications (2) and (4) as well as 9 dummies for occupational position, 4 firm size dummies and 10 industry dummies in specifications (3) and (4) as listed in table 1.